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(54) **Positioning an electro-acoustic transducer relative to a user's mouth**

(57) An optical path (15) is connected to a microphone (1), which only enables an object (2), such as for example a display device or a data display unit, to be viewed completely when the viewer (3) is in a specific position. This position is unambiguously reproducible and thus also the position of the microphone (1) relative to the mouth of the speaker (3). The optical path may be defined by an apertured sheet (Figures 2 and 3) or a tube (Figure 4).

The object may be a display device and may further comprise a slide projector (13) for generating variable data on a display (2). Since during the speaker identification process the means (13) for the generation of variable data projects consecutive instructions on the display device, the speech recognition process can be controlled automatically. The speaker (3) to be identified is then constantly forced to keep his mouth in the correct position relative to the microphone (1).

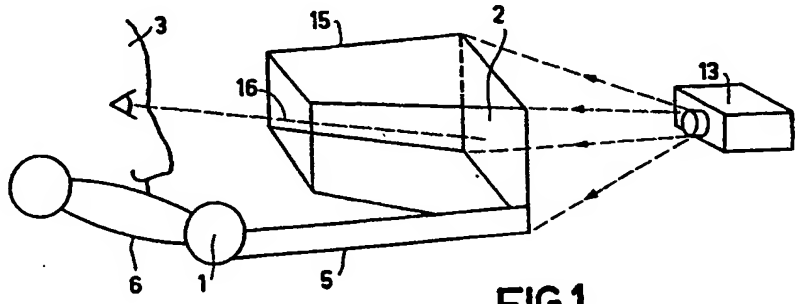

FIG.1

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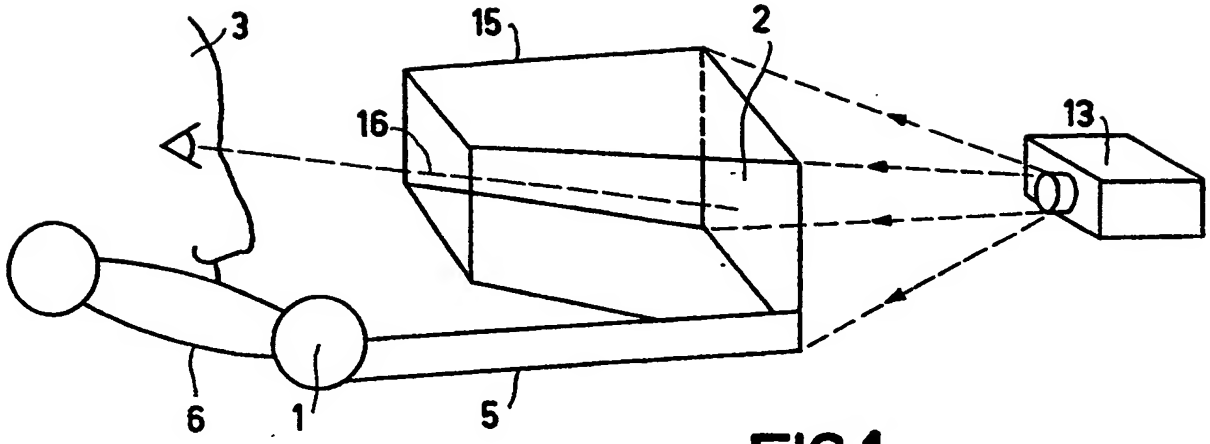

FIG.1

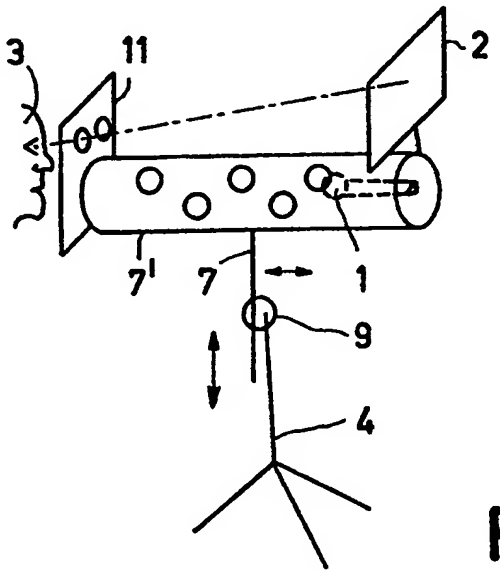

FIG.2

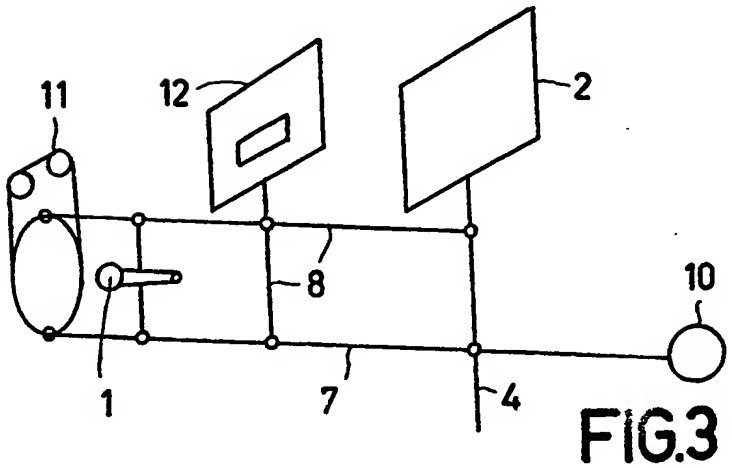

FIG.3

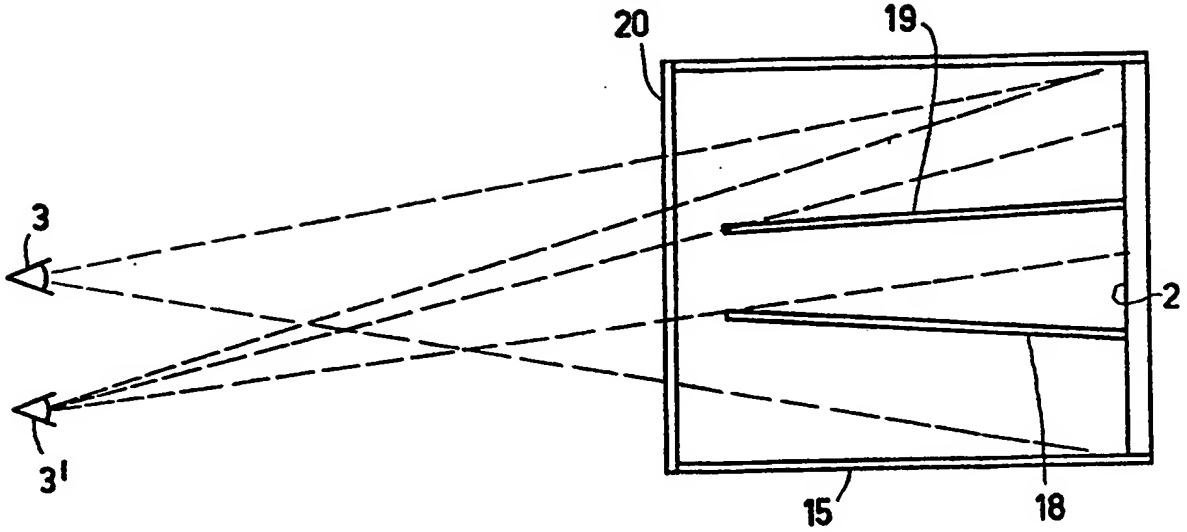

FIG.4

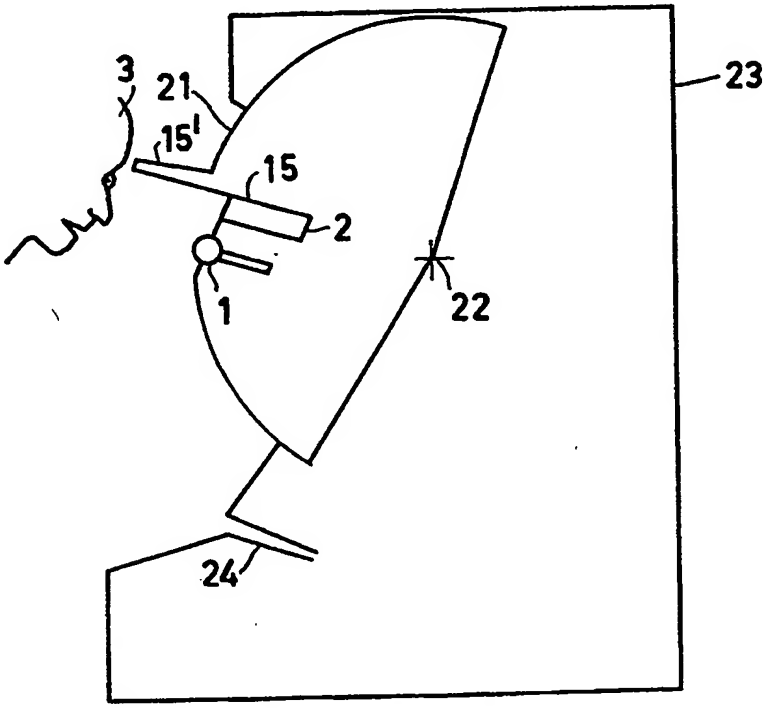

FIG.5

SPECIFICATION

Adjusting the position of a movable electro-acoustic sound transducer

The invention relates to a device for adjusting the position of a movable electro-acoustic sound transducer to a desired position relative to the mouth of a speaker.

Many methods for the automatic recognition or identification of speakers and for word recognition employ the long-term spectrum or the variation in time of short-term spectra as the characteristic which is typical of the speaker or word. This characteristic can only be used if the frequency transfer function for the sound signal between the mouth, or even between the vocal chords, and the signal processing system is reproducible, for which purpose the function itself need not be known.

As is known, both the radiation pattern of the mouth and the directional characteristic of microphones are frequency-dependent. If during different speech samples the microphone is held in different positions relative to the mouth, this will result in different frequency transfer functions. The spectrum of the speech signal is also noticeably influenced by the poise of the speaker's head. As a result of these effects, which add to the natural variations when the same sentence is repeated, a speech signal from a speaker may differ to such an extent from a speech signal previously uttered by the same speaker, that the reliability of the identification is substantially reduced.

In order to obtain a well-defined position between the mouth of the speaker and the microphone, the speaker can be given specific instructions. However, experience teaches that in a larger system, which is utilized by many different persons, the instructions are not strictly adhered to. Another possibility is to establish a well-defined position of the microphone relative to the mouth by means of a fixed mechanical connection of the microphone to a headset or by means of a simple bracket. However, wearing a headset is experienced as inconvenient by many persons, for example because it may affect head coverings or for hygenic reasons. A system to be used by the public in general, as for example in the banking trade needs to be capable of unambiguously defining a specific position of the transducer relative to the mouth in a most convenient way.

It is the object of the invention to provide a device of the type mentioned in the opening paragraph which enables a well-defined reasonably reproducible position of the microphone relative to the mouth of the speaker to be obtained as well as a reasonably well-defined orientation of the head, without requiring physical contact between the head and any mechanical parts of the device.

The invention provides a device as described in the opening paragraph characterised in that an optical path coupled to the sound transducer is arranged so that the speaker can only fully see an object along the optical path when the microphone of the position of the device relative to the speaker's eyes and thereby a well-defined position of the mouth of the speaker relative to the sound transducer. This adjustment is achieved without any contact with the device, apart from touching by the hands, which is generally accepted without any problems.

The well-defined position can also be obtained by a movement of the head. However, it is more effective to arrange for the sound transducer with the optical path to be movable. The sound transducer may then be a microphone which may be incorporated in a telephone handset.

In systems for indentifying a speaker said speaker enters some data, for example a code number, into the recognition system, in which the speaker's specific characteristics are stored and which compares the instantaneously produced speech signal or criteria derived therefrom with said characteristics. In order to simplify adjustment of the sound transducer the sound transducer and the optical path may be connected to an automatic adjusting device, which upon entry of said data or the code number sets the sound transducer to a position which is dependent upon a characteristic of the speaker.

The sound transducer and the optical path may be arranged and constructed in various ways, as is defined in the subclaims. In principle the construction of the object to be viewed is arbitrary. However, since for the purpose of speaker identification in conjunction with a financial transaction and for said transaction itself generally a display device for transferring data is required, the object is suitably a surface with graphical symbols or an optoelectronic display device. In speaker identification systems it is particularly advantageous if the object is a display device and if the device in accordance with the invention furthermore comprises means for the generation of variable data on the display device. In these cases it is particularly simple to display variable data on the device, as for example a decision taken by the system such as "recognised", "not-recognised" or variable data in the form of instructions to the speaker to be identified. Such an embodiment of the device in accordance with the invention has the following advantages:

1. it helps to produce a correct position of the mouth of the speaker relative to the microphone;
2. it enables the method of identifying a speaker to be controlled automatically by projecting instructions on the display device;
3. during the speaker identification process the speaker is encouraged to remain in the correct position relative to the microphone, because the instructions can only be read in this position.

Embodiments of the invention will now be described, by way of example with reference to the accompanying drawings, in which:-

Figure 1 shows schematically a first embodiment of a device according to the invention,

Figure 2 shows schematically a second embodiment of a device according to the invention,

Figure 3 show schematically a third embodiment of a device according to the invention,

Figure 5 shows schematically a fifth embodiment of a device according to the invention.

In the embodiment shown in Figure 1 an optical path in the form of a tube 15, which is open at both ends, is secured to a telephone handset 6 having the microphone capsule 1 *via* a mount 5, said tube being closed by an object in the form of a display device 2. The axis 16 of the tube 15 is directed at the eye of a speaker 3, who can fully observe display device 2 only in the position shown. The microphone capsule 1 of the handset 6 is then automatically in a well-defined position relative to the mouth of the speaker 3.

The embodiment shown in Figure 1 further comprises a device 13 for generating variable data on the display device 2. The device 13 may for example be a slide projector. During the speech recognition process the device 13 may for example project instructions or information for the speaker to be identified onto the display device 2. If the device 13 is then controlled by an automatic processor (not shown in the Figure) this enables the speech recognition process and thus the actions of the speaker to be identified to be controlled automatically by means of instructions on the display device 2.

Since the speaker can only observe these instructions if his eyes are in the indicated position relative to the tube 15 (which position corresponds to the afore-mentioned desired position of his mouth relative to the microphone capsule 1), he is encouraged to keep his mouth in the correct position relative to the microphone capsule 1 during the entire speaker identification process, thereby aiding the creation of suitable conditions for speaker identification.

Although the device 13 is not shown in Figures 2 to 5 it is obvious that such a device may also be used in the embodiments shown in those Figures.

Figure 2 shows a sound transducer in the form of a microphone 1 arranged in a tube 7', which is formed with lateral apertures in order to avoid distinct resonances. Alternatively the tube 7' may be formed from a meshed material. A mount 7 is secured to the tube, which mount is fixed to the holder 4 so as to be pivotable and vertically movable, *via* a device 9 as is indicated by the arrows. The device 9 may for example comprise a motor controlled by an identification system (not shown) which adjusts the rod 7 perpendicularly relative to a position associated with the relevant speaker, so that the speaker need only apply minor corrections by pivoting the device.

On the one end of the tube 7' there is arranged a diaphragm 11 and on the other end an object 2 in the form of a writing tablet or display device. A speaker 3 located in front of the tube 7' then pivots the tube 7', so that the apertures in the diaphragm 11 just reveal the entire display device 2.

Figure 3 shows an embodiment in which the microphone 1 as well as the diaphragm 11 and a further diaphragm 12 are mounted on a fixed holder 4 *via* a parallelogram guide by means of the mounts 7 and 8. The lower mount 7 is provided with a counterweight 10, so that after adjustment the adjusted position is maintained. By the use of two diaphragms the tolerance range of the position in through the apertures of the diaphragm 11 and 12 is further reduced, so that the positioning of the speakers mouth with respect to the microphone may be more accurately established.

Figure 4 is a side view of a laterally open tube 15, which surrounds a display device 2. In this tube two intermediate walls 18 and 19 are arranged in the viewing direction. As a result of this, a speaker 3 can completely view the entire surface area of the display device 2. However, a speaker 3' can only observe the display device 2 partly, as shown in the Figure.

Between the viewer 3 and the display device 2 there is arranged a phase grating or amplitude grating 20, which also enables the complete display device 2 to be observed from a specific viewing direction only. The intermediate walls 18 and 19 may then be dispensed with.

In a housing 23, as is shown in Figure 5, a circularly cylindrical segment 21 is arranged so as to be rotatable about an axis 22. The surface of this circular cylinder is interrupted at one end by a tubular optical path 15, whose other end is terminated by a display device 2. This display device may also be arranged near the axis 22. Furthermore, there is provided a projecting portion 15' on the surface of the circularly cylinder segment 21 in line with the optical path 15, which ensures that the speaker 3 remains at a specific distance from the microphone 1, which microphone is arranged underneath the optical path 15 in the circularly cylindrical segment 21. Underneath the circularly cylindrical segment 21 a slot 24 is formed through which an identification card may be inserted or for example cash may be handed over.

CLAIMS

1. A device for adjusting the position of a movable electro-acoustic sound transducer to a desired position with respect to the mouth of a speaker, characterised in that an optical path coupled to the sound transducer is arranged so that the speaker can only fully see an object along the optical path when the microphone is located at the desired position.

2. A device as claimed in Claim 1, characterised in that the second transducer is the microphone capsule of a telephone handset, to which the optical path and the object are secured so that the object is further from the speaker than the microphone capsule of the handset.

3. A device as claimed in Claim 1, characterised in that the sound transducer and the optical path are arranged on a pivotable elongate mount.

4. A device as claimed in Claim 3, characterised in that the sound transducer and the optical path are arranged on the mount so as to be movable in parallel on a fixed holder by means of a parallelogram guide.

5. A device as claimed in Claim 3 or 4, characterised in that the mount is vertically movable on a fixed holder.

6. A device as claimed in Claim 1, characterised in that at least the sound transducer and the optical

circularly cylindrical segment which is rotatable about its axis.

7. A device as claimed in any of Claims 3 to 6, characterised in that the sound transducer and the optical path are connected to an automatic control device, which upon vocal entry of some data sets the sound transducer to a position which is dependent on a characteristic of the speaker.

8. A device as claimed in any of Claims 3 to 7, characterised in that the object is connected to the optical path and the sound transducer.

9. A device as claimed in any preceding claim, characterised in that the optical path comprises at least one optical diaphragm, which is arranged near the speaker between the speaker and the object.

10. A device as claimed in any preceding claim, characterised in that the optical path is a tube which is open at both ends, whose longitudinal axis extends in the viewing direction, which tube or its extension surrounds the object.

11. A device as claimed in Claim 10, characterised in that the tube is also laterally open.

12. A device as claimed in Claim 10 or 11, characterised in that inside the tube intermediate walls are arranged which extend in the viewing direction.

13. A device as claimed in any preceding claim, characterised in that phase gratings or amplitude gratings are arranged in the optical duct.

14. A device as claimed in any preceding claim, characterised in that the object is a surface bearing graphical symbols.

15. A device as claimed in any preceding claim, characterised in that the object is a display device and the device further comprises means for generating variable data on the display device.

16. A device as claimed in any preceding claim, characterised in that the object is an opto-electronic display device.

17. A device for adjusting the position of a movable electro-acoustic sound transducer to a desired position with respect to the mouth of a speaker substantially as described herein with reference to Figure 1,2,3,4 or 5 of the accompanying drawings.

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